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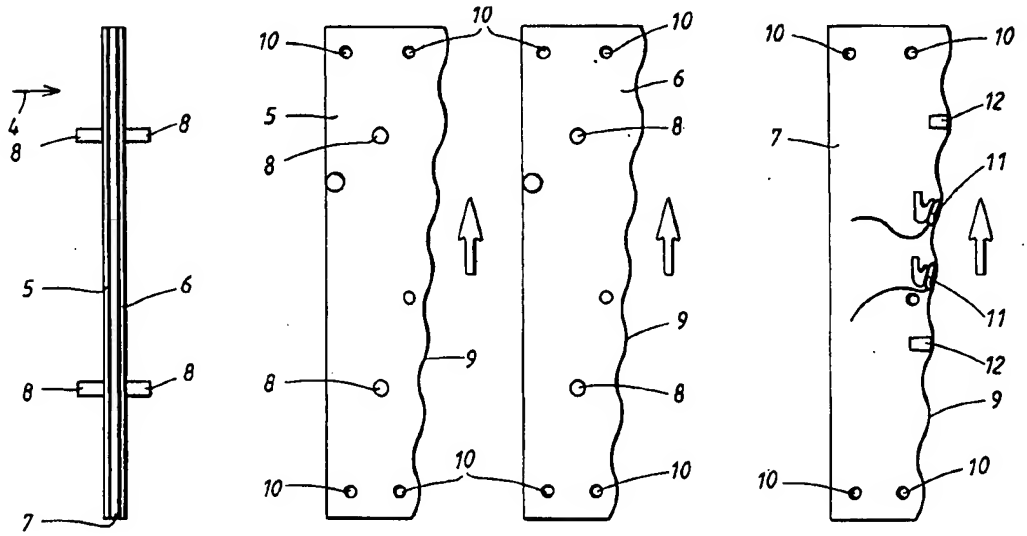
(54) Title: DEVICE FOR INVESTIGATING THE GRINDING PROCESS IN A REFINER INCLUDING SENSORS



(57) Abstract

The present invention relates to a measuring of the beating process in a refiner comprising sensors (11, 12) for sensing pressure and temperatures arranged in one or more radial bars (4) which are mounted in or between the beating segments (1, 2) of the one or both beating disks. The invention is characterized in that bars (4) on that side which faces the beating mass and in or close to which the sensors (11, 12) are mounted are wave or saw tooth formed.

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TITLE:

Device for investigating the grinding process in a refiner including sensors

TECHNICAL FIELD:

The present invention relates to an arrangement for measuring the beating process in a refiner for beating wooden chips and coarse pulp to finer pulp and which comprises sensors for sensing pressure and temperatures. These sensors are arranged on or in radial bars which are mounted on or between the beating segments of one or the both beating disks.

PRIOR ART:

When beating wood chips in a refiner for creating cellulose fibres the wood chips are fed in a water suspension in between two normally vertical disks which rotate in relation to each other and which carry out the beating itself. The medium flow between the disks occur from the centre and out towards the periphery. Even other forms of refiners comprising a cone which rotate within another cone are known. These refiners and also other types are well-known within the cellulose industry.

To obtain a desired result of the beating it is necessary that the parameters which are deciding in the beating process can be controlled in a desired way. These parameters are the feed velocity of chips/pulp suspension and the concentration of chips/pulp therein, the distance between the beating disks which influences the pressure of the mass suspension between the disks, the temperature in the mass suspension during different periods of the beating process, the rotation velocity of the beating disks compared to each other etc. To be able to control the beating process in dependence of these different parameters pressure and temperature sensors have been arranged according to the prior art in one of the beating disks along the radius of

these. These sensors can be arranged in a radial row or be radially displaced in relation to each other and be screwed in or in some other way fastened to one of the beating disks or the back piece on which the disks are fastened. They can also be arranged on a radial bar which is mounted on or between the beating segments. The electric wires which must go from the senors to some indication apparatus or computer are usually collected in a cable on the rear side of one of the beating disks. Such arrangements are for example described in the US patent specification 4,148,439 and the international patent application WO 96/14156. These patent specifications are examples of the fact that the beating conditions in a refiner are very important and must be followed with good accuracy since they influence the properties of the pulp. Therefore good direct measure of pressure and the temperature is required so that the properties in form of quick variations can be followed. Within the control technique this is usually defined such that a small rising time on the sensor is required if quick dynamic conditions are to be followed.

TECHNICAL PROBLEM:

To fulfil the desire of a small rising time on the sensor it is necessary that the sensors are not covered with resin and/or fibres but can be kept clean and are arranged in the immediate vicinity of the mass suspension. According to the known arrangements the problem exists that the cavities for the sensors are quickly filled with resin and fibres which results in that the sensors will have a far too long rising time for controlling purposes and that the pressure sensors, if they are of a membrane type, cease to work due to resin and fibres forming a hard surface which makes it impossible to sense the pressure of the steam and fibre mass. Even if the sensors are arranged in or on a bar clogging problems arise since the sensors are located in

discrete cavities in the bar. Moreover, it is mounted approximately 5 mm below the surface of the beating bars.

The temperature of the beating material rises from the centre and outwardly towards the periphery which appears from the patent specification WO 96/14156. This means that the risk for assembling resin and fibres most easily is obtained at the so called pressure peak which is located about half the radius outwardly since a certain stagnation of the mass flow is obtained at this position. This stagnation is caused by a changing direction of the steam in this position. At this so called pressure peak also usually the profile of the beating disks and the gap between them will be some less narrowing outwardly.

According to this known technique also the width of the bar is too large and is up to more than 8 mm. This is primarily due to strength resistance reasons. However it is desirable that the width is minimised further, down to about 5 mm to resemble the width of the so called "dams".

THE SOLUTION:

According to the present invention the problems above have been solved and an arrangement for measuring the beating process in a refiner comprising sensors for sensing pressures and temperatures arranged in one or more radial bars which are mounted in or between the beating segments of one or both beating disks has been brought about whereby the arrangement is characterized in that the bars on that short side which faces the beating material and in or near which the sensors are mounted are wave or saw tooth shaped.

It is according to the invention suitable that the bars consist of more, suitably three disk-shaped elements coupled to each other and with identic profiles on the short side towards the beating material.

The sensors are according to the invention suitably mounted on the middle of the three disks.

The temperature sensors are according to the invention suitably located on the side of the middle disk, about 0,5 mm from the short side on a rising wave or tooth from the centre.

It is according to the invention suitable that the pressure sensors are arranged in a drilling hole in the short surface on the top of a wave or a tooth since risks for clogging is least in that position.

Further it is according to the invention suitable that at the area of the bars where the beating mass has its highest pressure, namely at the so called stagnation point, the wave or tooth shape is less pronounced and the surface of the short side lies somewhat closer to the beating surface since local turbulence phenomena may arise in that position.

It is according to the invention suitable that the short side with exception of the wave or saw tooth form mainly follow the form of the beating segment from the centre out towards the periphery.

According to the invention channels are formed in one or more of the disks for housing cables from the sensors.

The total thickness of the bars should according to the invention not exceed 5 mm.

To improve the dirt-repelling ability the short side of the bar should according to the invention be covered with a hydrophobic layer.

FIGURE DESCRIPTION:

The invention will in the following be described more in detail in connection with the enclosed figures, where

fig. 1 shows a view of a segment of a beating disk seen from that side which faces the other beating disk and where the beating occurs, where

fig. 2 shows a bar both joined and taken apart where

fig. 3 shows a section of the bar according to the invention having a different profile of the shorter side, where

fig. 4 shows how the sensors are placed and where

fig. 5 shows a further variation of the bar according to the invention.

DETAILED DESCRIPTION:

Fig. 1 shows a part of a beating disk arranged on the stator side having the beating segments 1 and 2. The rotor disk rotates in the direction of the arrow at the side of the disk and the beating material flows outwardly in the direction which is shown with arrows on the segments 1 and 2. These beating disks are, which is partly shown, provided with beams 3 which brings about or facilitates the beating itself. Between the disk segments 1 and 2 a bar 4 with sensors has according to the invention been arranged. The wires from the sensors are collected in a cable.

Fig. 2 shows a bar 4 according to the invention. It consists of tree approximately rectangular disks 5, 6 and 7 whereby the disks 5 and 6 form the outer disks. These disks can be kept together either by a heat resistant glue or by being screwed together. They may also be provided

with pins 8 to facilitate the mounting of the bar at the segments 1 and 2. The different parts 5, 6 and 7 of the bar 4 are shown demounted whereby it appears that they have the same shape and are on the shorter side 9 which faces the other beating disk and the beating material wave shaped. If some other mounting of the disks with each other than by means of a heat resistant glue is wanted these may be screwed together through the screw holes 10. The beating material, i.e. the suspension of water and chips and already beated fibre flows outwardly past the wave shaped short side 9 of the gap such as the arrows show.

The temperature sensors 11 and the pressure sensors 12 are arranged in or near the short side 9 as shown on the disk 7.

Fig. 3 shows another embodiment example of the bar according to fig. 2 where the waves on the short side 9 has been replaced by a saw tooth form. The suspension which flows in the direction of the arrow lifts up the beated material so that it will not get any chance to cover the surface. A certain risk for gathering of solid material exist in the inner corners on the lee side of the peak but this dirt does not mean very much since the sensors are arranged on the upward going parts of the surface or on the peak itself. Fig. 3 shows accordingly the disk 7 in another configuration than the one according to fig. 2.

Fig. 4 shows in an enlarged scale the wave form of the disk 7. As appears from the figure the temperature sensor 11 is arranged on the upward going part of the wave whereas the pressure sensor 12 is arranged on the peak of the wave. The pressure sensor 12 is arranged in a drilling hole in the disk whereas the temperature sensor 11 is on the side of the disk and preferably approximately 0,5 mm from the edge of this short side. Grooves are arranged in the disk so

that the cables from the sensors can be led out on the rear side of the beating disk.

The temperature sensors may be platinum elements, for example Pt-100 element. They are attached with laser etched attaching means on the disk. To minimise their rising time they are arranged tightly on the metal. A suitable type of Pt-100 element consists of the thin film type so that the platinum surface shall get a good contact with the bar. Thread coiled Pt-100 element may also be used but at the cost of substantially longer rising times because the thread thereby also measures the temperature of the underlying medium. With the solution according to the present invention the width of the bar which is the total thickness of the three parts, can be minimised under 5 mm which is of great importance to minimise mass particles.

As above said in connection with fig. 2 pins 8 are arranged on the bar for the mounting. It may also be screwed into the base plate via through going holes but the disadvantage with this solution is that the width of the bar is increased since a sufficiently large screw must be used for maintaining reasons.

With the purpose to minimise the risk for mass particles and prevent resins and fibre deposits on the grinding surface of the bar it is advantageous if the fibre mass quickly is lifted up to the beating surface directly after the measuring. This can be performed in that the surface of the bar has a wave or saw tooth pattern such as shown above. In this construction the wave peak will accordingly lie closer to the beating surface and it is accordingly advantageous that the pressure sensors are placed at this point since measuring of "impact/bom" is interesting together with the measuring of the saturation or possible superheating of the steam created through the beating. The

temperature sensors can however advantageously be arranged on an upwardly going way from the centre with the aim to use the cleaning effect of the forward flowing steam. Also other pattern forms may be imaged which lift the fibre mass towards the beating surface.

The main resin and fibre deposit will occur at the so called stagnation point where the profile of the beating disks is changed to run more parallely. To minimise the risk therefore the wave form in this region is arranged less pronounced and the short side can there have a somewhat more even surface which also can be brought closer to the beating surface with the goal to use the lower steam velocity maximally for better rinsing. Fig. 5 shows the section of the short side 9 where the more even surface at the stagnation point is arranged.

The deposit on the bar and the sensors can also be lowered by arranging a hydrophobe layer on these elements. This layer can for example consist of a mixture of tungsten carbide and polytetrafluoro ethylene. Thereby the flushing of resin and fibres from the surface of the bar by means of the forward and backward flowing steam is facilitated.

Through the present invention a fastening arrangement for the sensors which is such that these do not come out of function or get a decreased or deferred rising time has accordingly been created. The short side of the bar may have different shape within the scope for what can be regarded as wave formed or saw tooth formed.

The invention is not limited to the embodiment examples shown but it can be varied in different ways within the scope of the claims. Thus it can for example be mentioned that large refiners often have two radially displaced beating rings compared to each other whereby the inner ring

is called the "breaker bar" ring. Also in this inner ring the bar according to the present invention can be arranged. However, only one bar is preferred.

PATENT CLAIMS:

1. Arrangement for measuring the beating process in a refiner comprising sensors (11, 12) for sensing pressure and temperatures arranged in one or more radial bars (4) which are mounted in or between beating segments (1, 2) of one or both beating disks, c h a r a c t e r i z e d i n that the bars (4) on the short side (9) which faces the beating mass and in or close to which the sensors (11, 12) are mounted are wave or saw tooth formed.

2. Arrangement according to claim 1, c h a r a c t e r i z e d i n that the bars (4) consist of more, suitably three, disk shaped elements (5, 6, 7) coupled to each other and with identic profiles on the short side 9 towards the beating mass.

3. Arrangement according to any of the claims 1 or 2, c h a r a c t e r i z e d i n that the sensors (11, 12) are mounted on the middle (7) of three disks (5, 6, 7).

4. Arrangement according to any of the claims 1-3, c h a r a c t e r i z e d i n that the temperature sensors (11) are arranged on the side of the middle disk (7) about 0,5 mm from the short side (9) on from the centre upwardly rising wave or tooth.

5. Arrangement according to any of the claims 1-4, c h a r a c t e r i z e d i n that the pressure sensors (12) are arranged in a drilling hole in the short side on top of a wave or tooth.

6. Arrangement according to any of the claims 1-5, c h a r a c t e r i z e d i n that at the area of the bars where the beating mass has its highest pressure, namely at the so called "stagnation point" the wave or

tooth forming is less pronounced and the surface (13) of the short side lies somewhat closer to the beating surface.

7. Arrangement according to any of the claims 1-6, characterized in that the short side 9 with the exception of the wave or saw tooth forming substantially follows the shape of the beating segments from the centre out towards the periphery.

8. Arrangement according to any of the claims 1-7, characterized in that channels are shaped in one or more of the disks (5, 6, 7) for housing cables from the sensors (11, 12).

9. Arrangement according to any of the claims 1-8, characterized in that the total thickness of the bars (5, 6, 7) does not exceed 5 mm.

10. Arrangement according to any of the claims 1-9, characterized in that the short side (9) of the bars is covered with a hydrophobic layer.

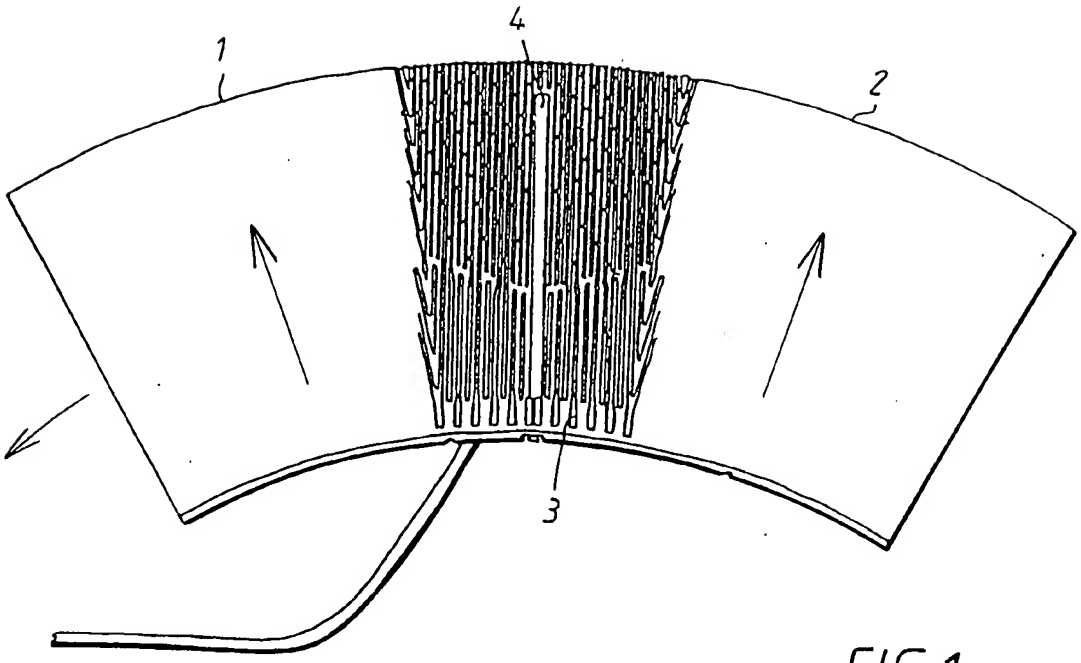

FIG.1

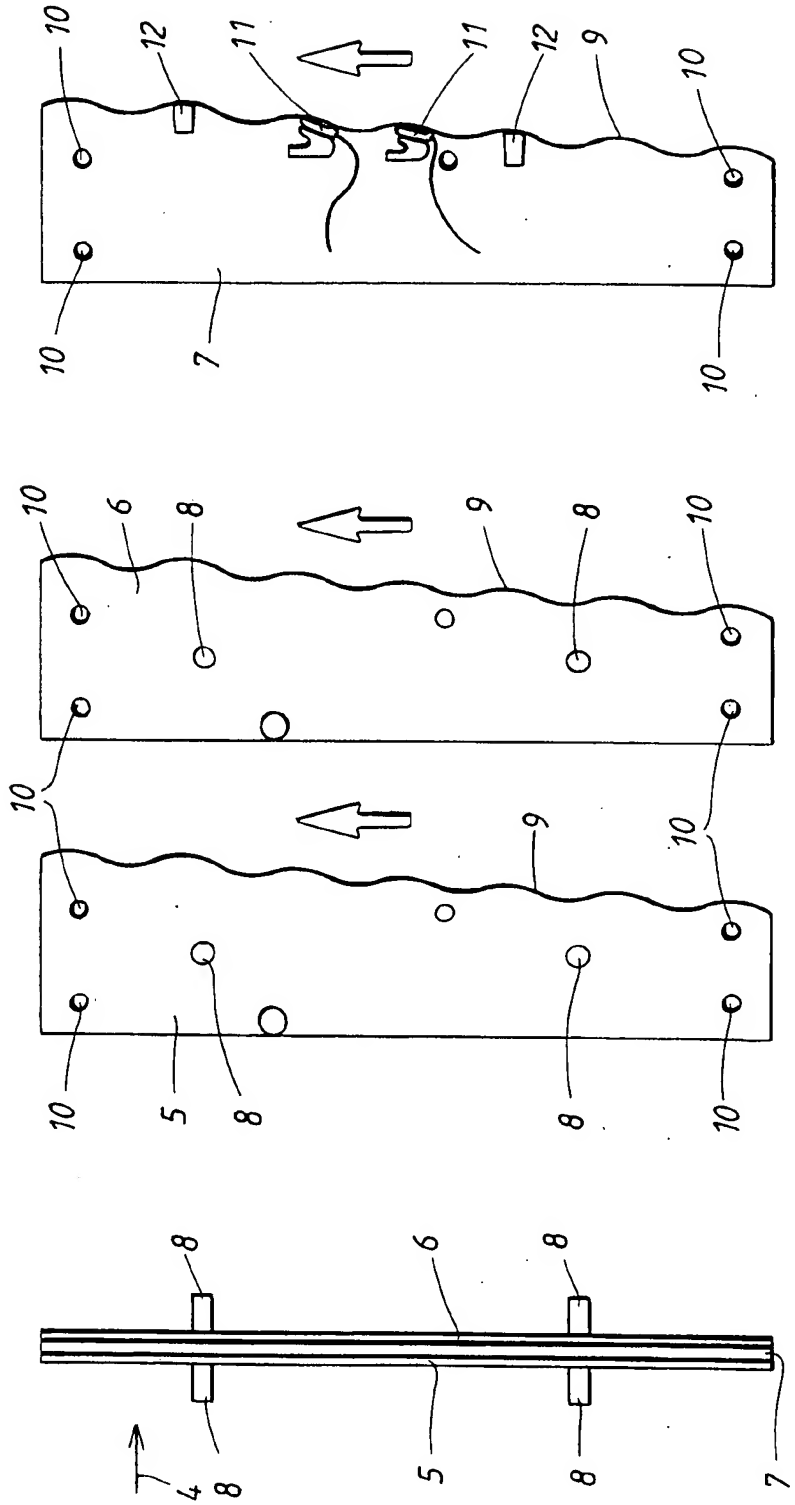

FIG.2

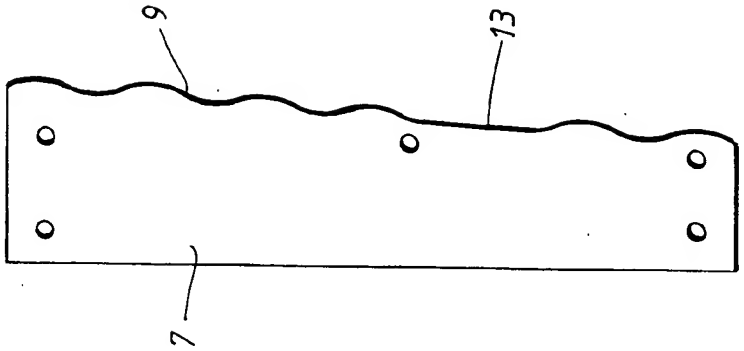

FIG.5

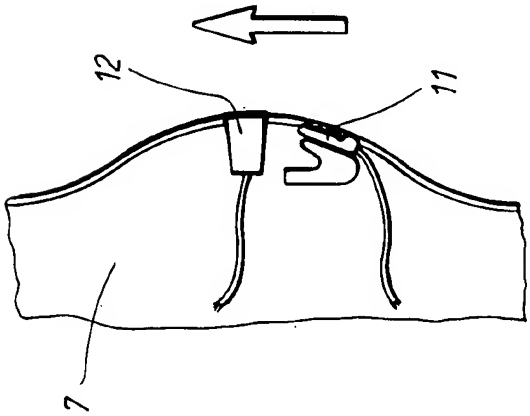

FIG.4

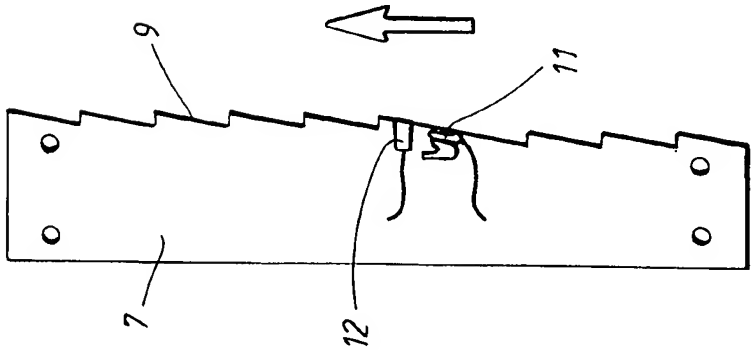

FIG.3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 98/00771

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B02C 7/14, D21B 1/14, D21D 1/30
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B02C, D21B, D21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4148439 A (MATS FLODEN), 10 April 1979 (10.04.79), figure 1, abstract ---	1
A	WO 9614156 A1 (3 PC AB), 17 May 1996 (17.05.96), figures 1-3, abstract --- --------	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Information on patent family members

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International application No.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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